US009080695B2

(12) **United States Patent**
Magno, Jr.

(10) **Patent No.: US 9,080,695 B2**
(45) **Date of Patent: Jul. 14, 2015**

(54) **STRUT AND TRAPEZE SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/765,847**

(22) Filed: **Feb. 13, 2013**

(65) **Prior Publication Data**

US 2013/0248660 A1 Sep. 26, 2013

Related U.S. Application Data

(60) Provisional application No. 61/615,407, filed on Mar. 26, 2012.

(51) **Int. Cl.**

E21F 17/02	(2006.01)
F16L 3/00	(2006.01)
F16L 3/133	(2006.01)
F16L 3/227	(2006.01)
A47H 1/10	(2006.01)

(52) **U.S. Cl.**

CPC ***F16L 3/133*** (2013.01); ***F16L 3/227*** (2013.01); *F16L 3/00* (2013.01)

(58) **Field of Classification Search**

USPC 248/317, 327, 340; 403/232.1, 233, 403/237, 241, 245, 246, 263, 49, 188

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

618,603	A		1/1899	Henneman
1,606,289	A	*	11/1926	Bowers 248/327
2,735,157	A	*	2/1956	Hotchkiss et al. 27/12
2,936,988	A	*	5/1960	Bodian 248/228.1
3,226,076	A	*	12/1965	Spuhler 248/327
3,233,297	A		2/1966	Havener
3,752,902	A		8/1973	Wilson
3,854,684	A		12/1974	Moore
3,918,234	A	*	11/1975	Weissman 52/39
3,938,767	A		2/1976	Norris
4,232,847	A		11/1980	Cooper
4,426,822	A	*	1/1984	Gailey 52/669
4,742,979	A		5/1988	Syversten et al.
5,102,074	A		4/1992	Okada
6,012,691	A		1/2000	van Leeuwen et al.
6,748,705	B2	*	6/2004	Orszulak et al. 52/167.1
6,807,791	B2	*	10/2004	Herb 52/846
7,651,056	B2		1/2010	Tjerrild
7,661,915	B2		2/2010	Whipple
7,926,766	B2		4/2011	Tjerrild
7,931,242	B2		4/2011	Tjerrild
7,946,540	B2		5/2011	Drane et al.
2009/0090820	A1		4/2009	Tjerrild
2010/0084519	A1		4/2010	Tjerrild
2011/0163208	A1		7/2011	Tjerrild

FOREIGN PATENT DOCUMENTS

CA	2121373	4/1993
CA	2182172	8/1995
CA	2385956	4/2001

* cited by examiner

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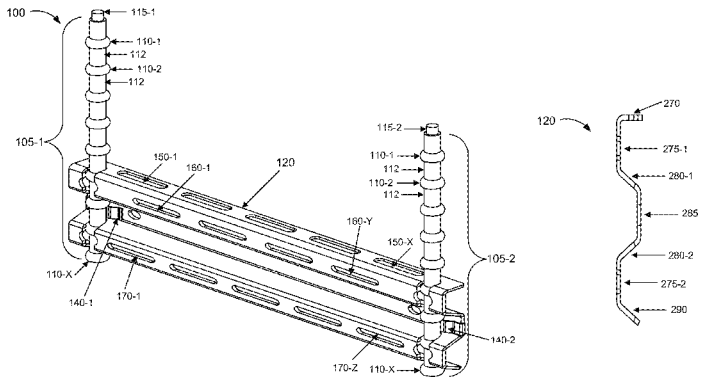
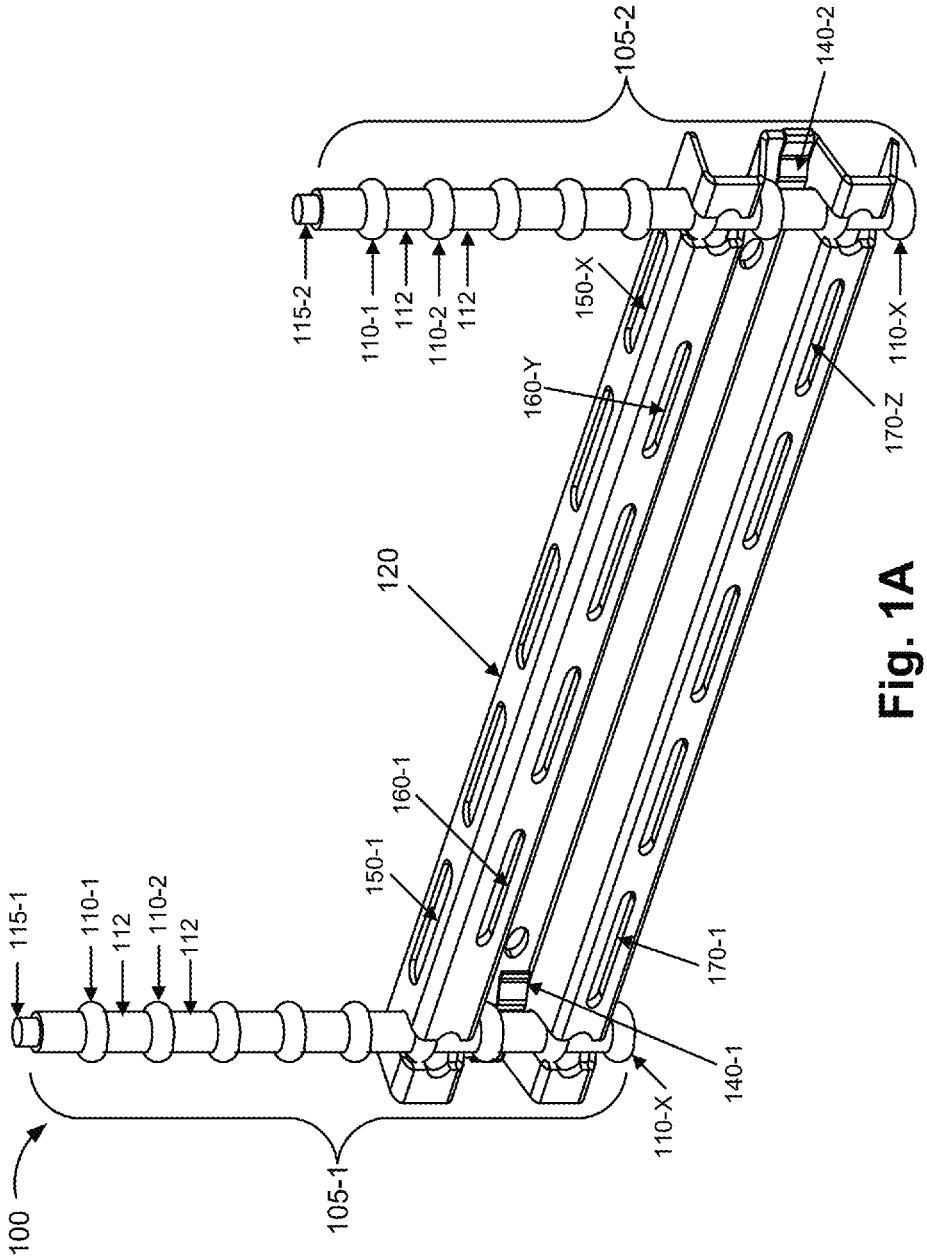
(57) **ABSTRACT**

An assembly comprising a strut comprising mounting holes to affix one or more attachments and one or more fixtures to the strut, and support holes shaped to receive and couple beaded rods with the strut for suspension of the strut, wherein the strut is coupled to the beaded rods without a threaded coupling.

18 Claims, 26 Drawing Sheets

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110-2
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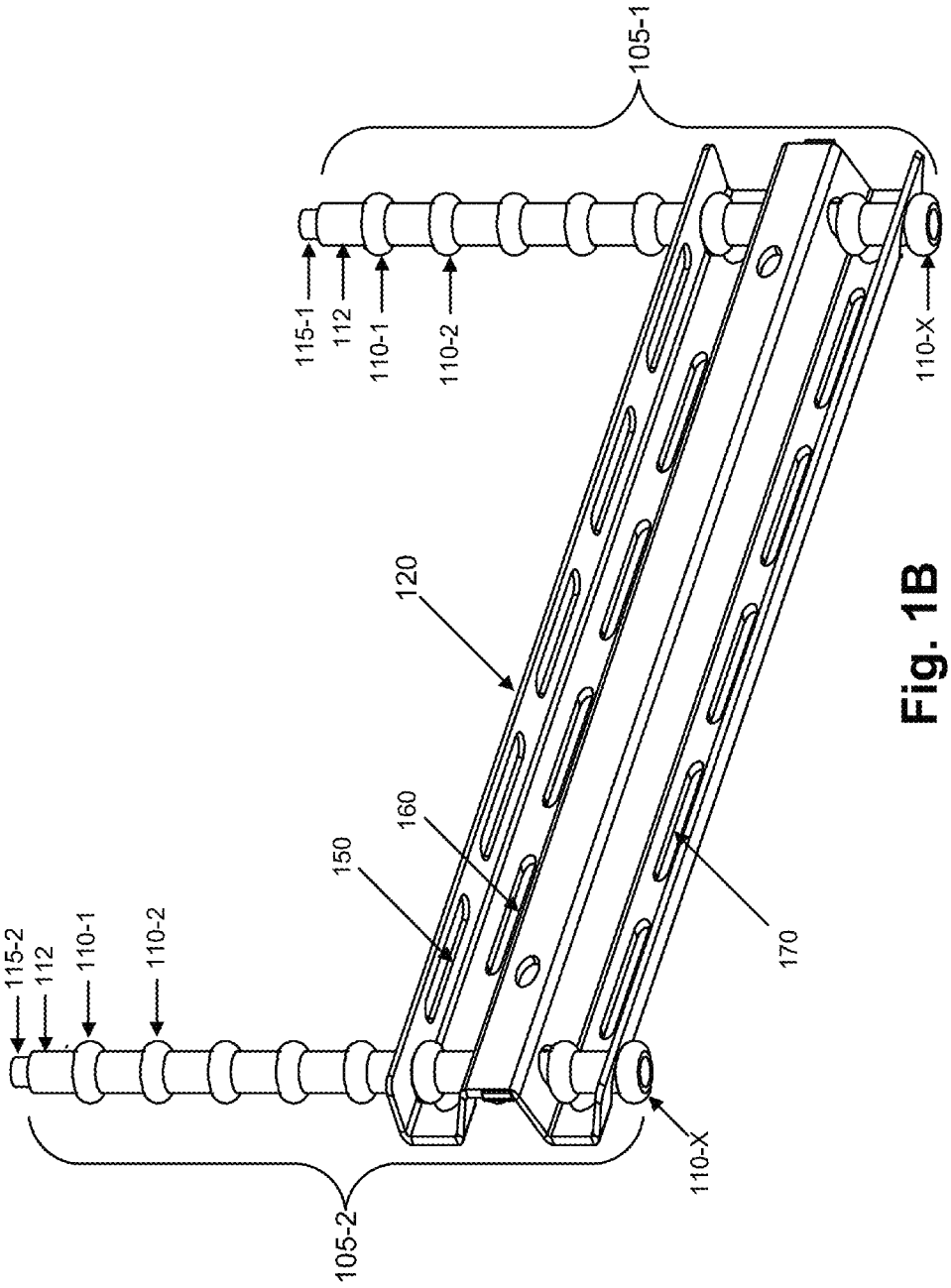
140-1
110-X
105-1
100

Fig. 1A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110-1
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110-X
105-2

Fig. 1B

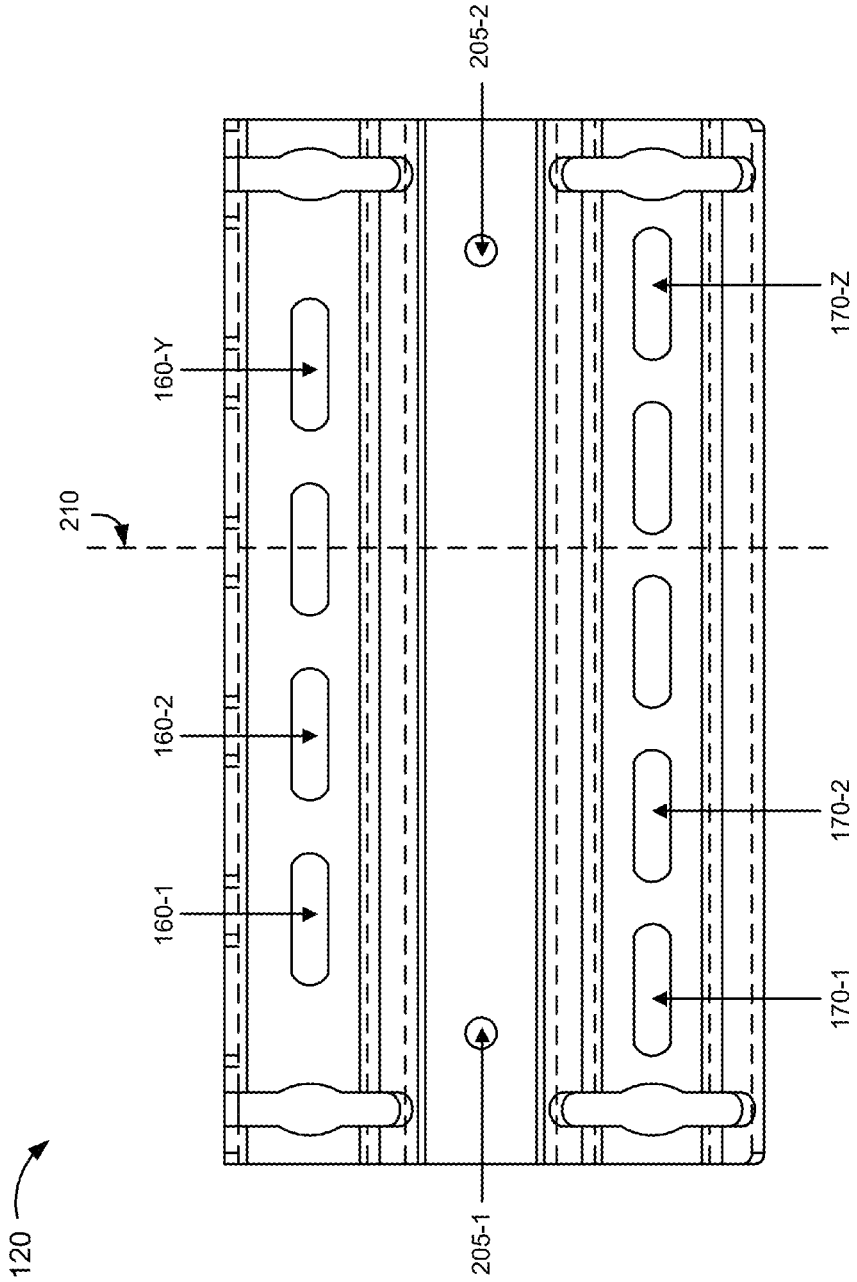


Fig. 2A

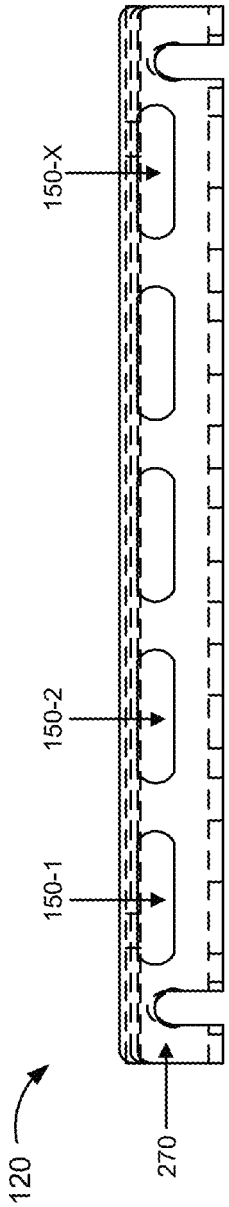


Fig. 2C

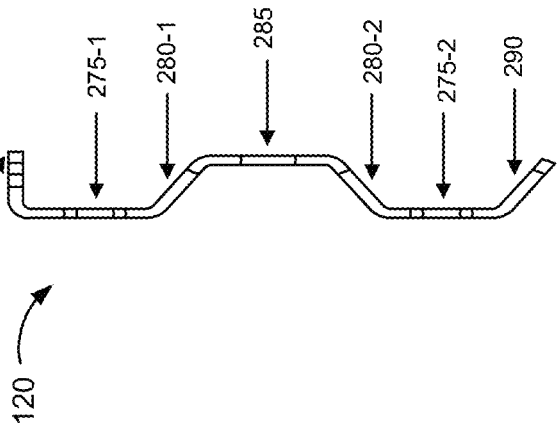


Fig. 2B

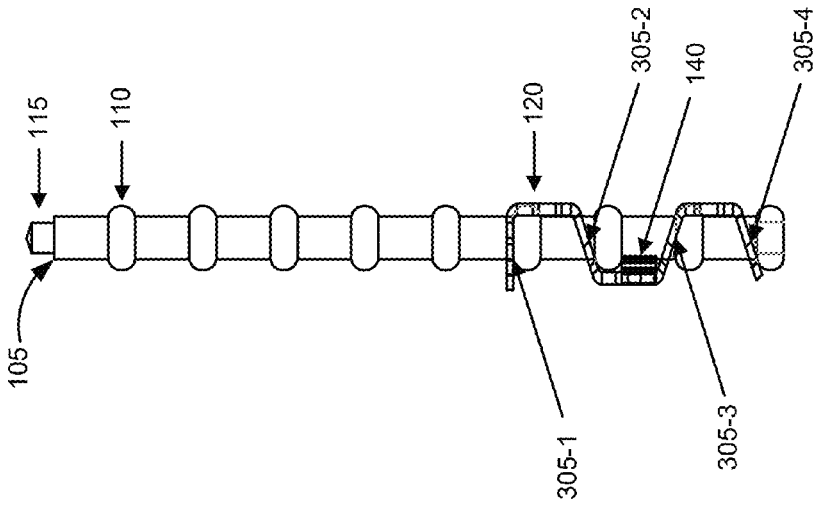
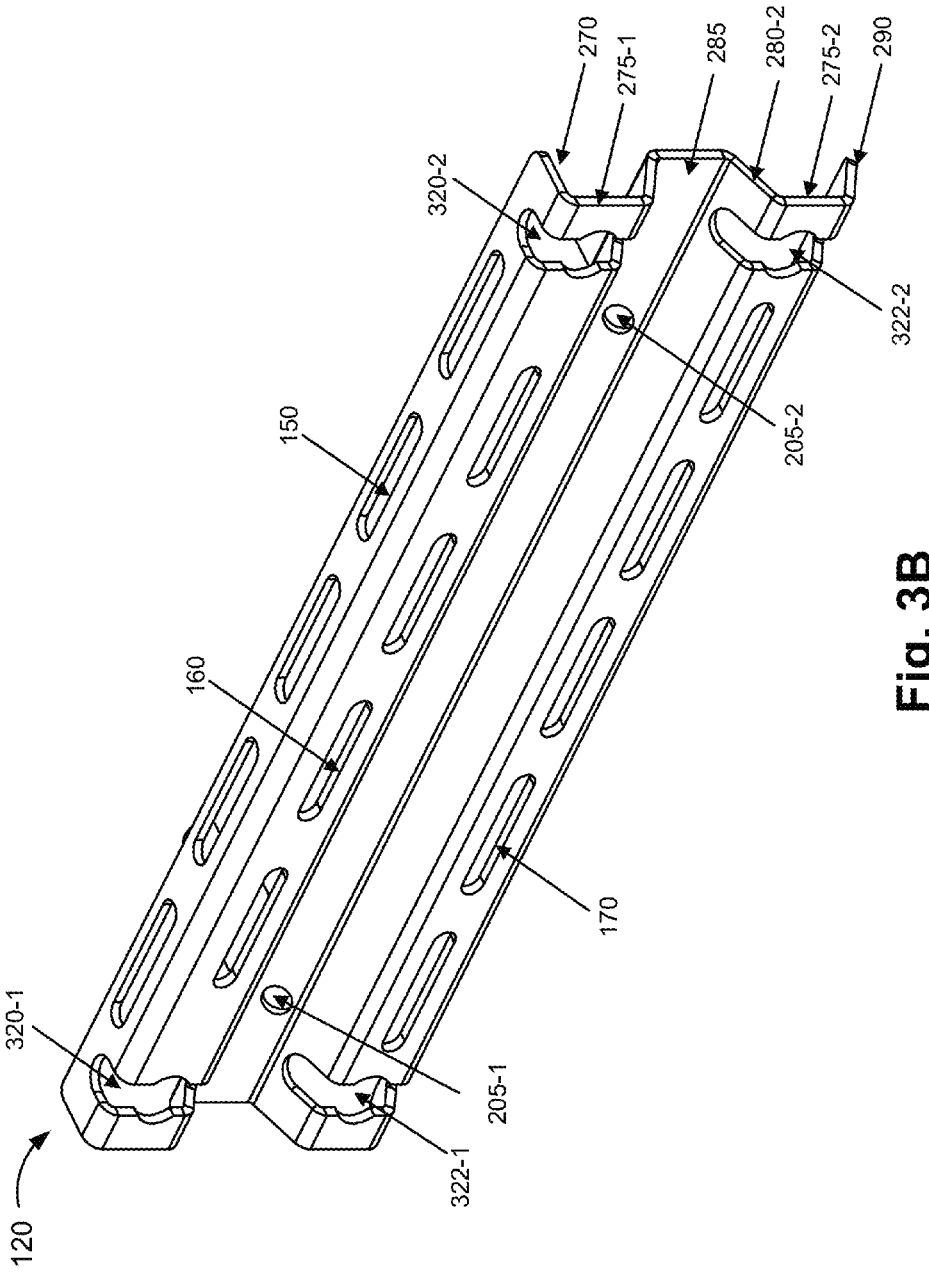


Fig. 3A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285
280-2
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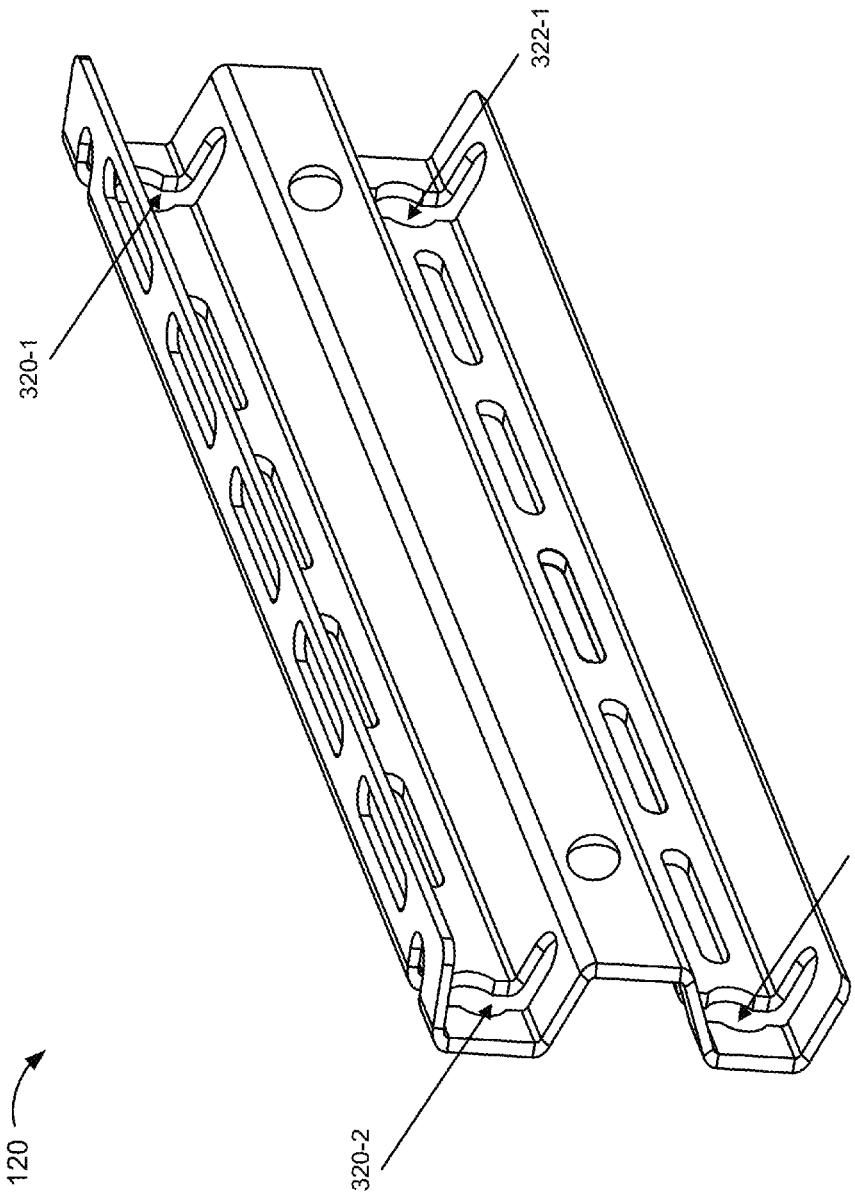
322-2
205-2
150
160
170
320-1
205-1
322-1
120

Fig. 3B



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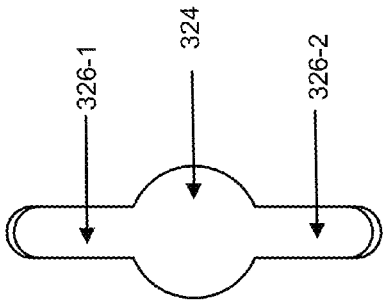


Fig. 3D

320/322

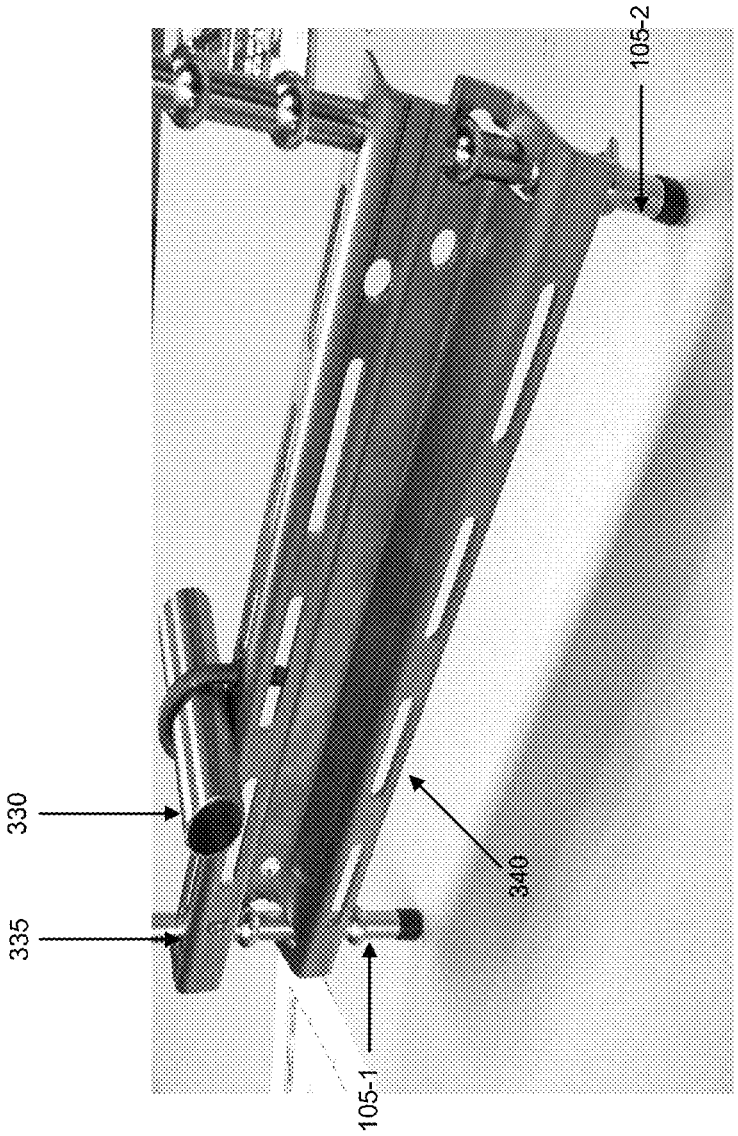


Fig. 3E

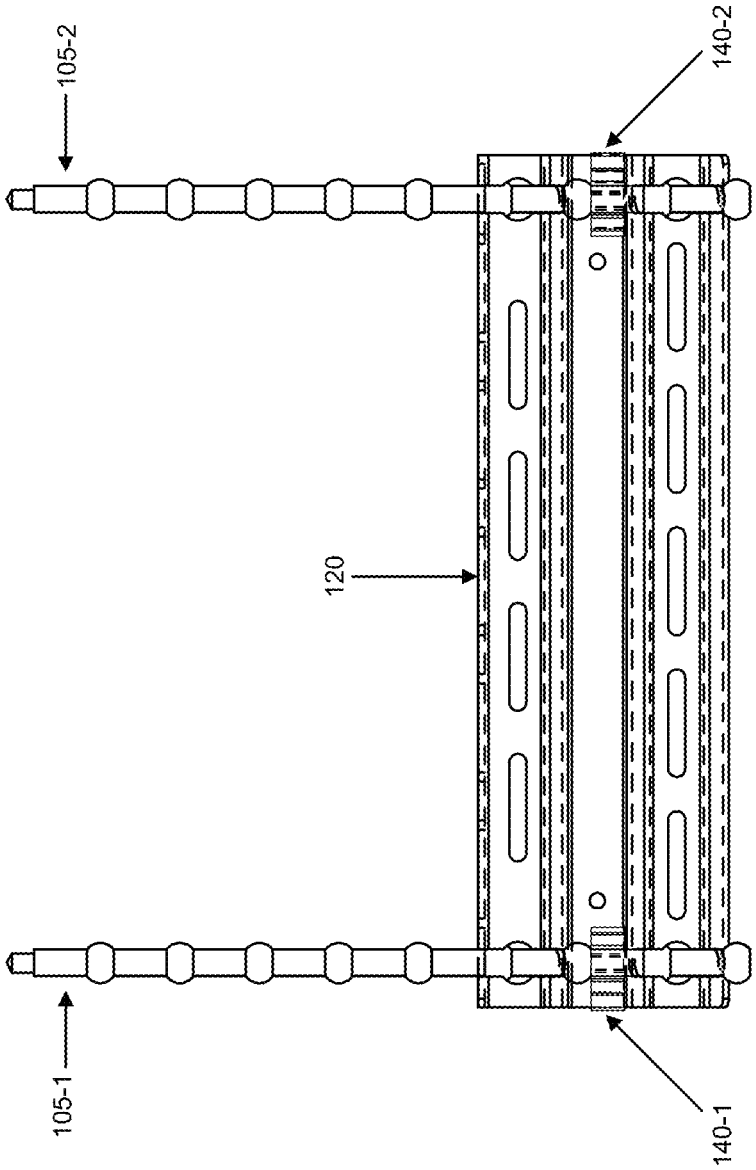
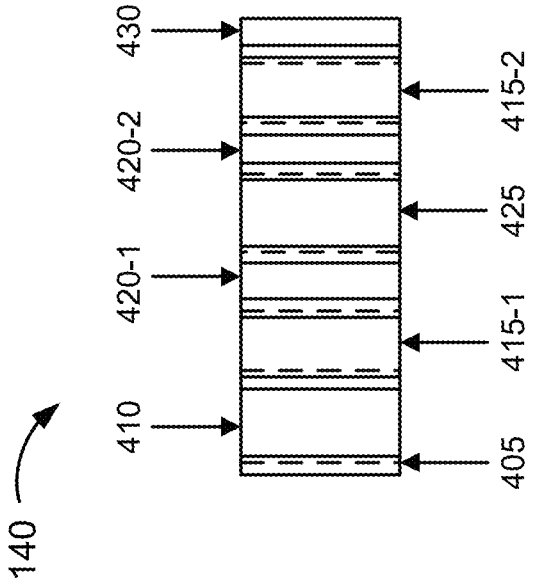


Fig. 4A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405
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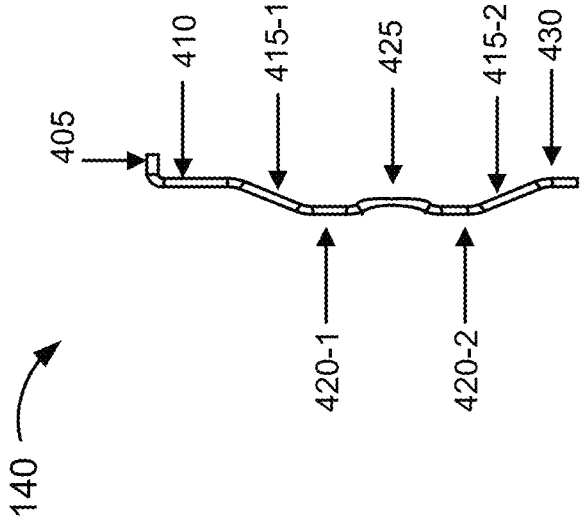
425
415-2

Fig. 4C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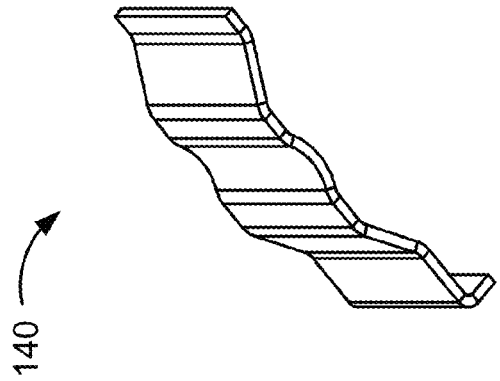
420-2

Fig. 4B



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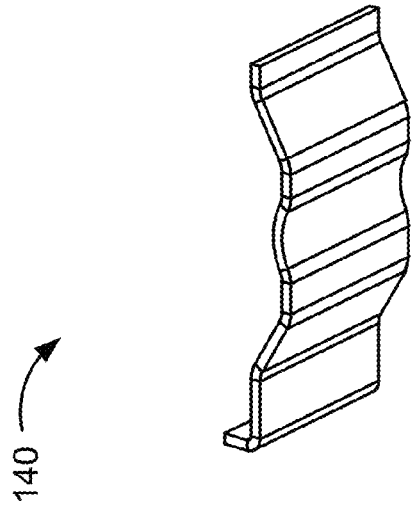

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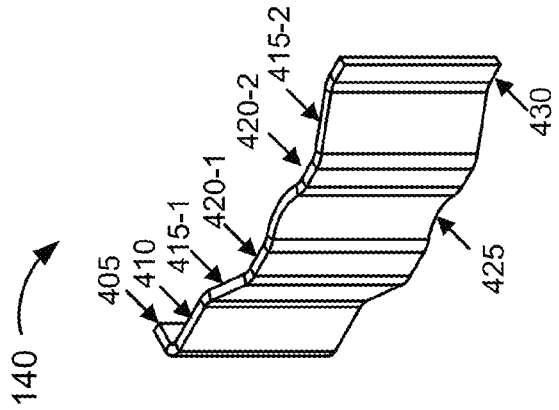


Fig. 4D

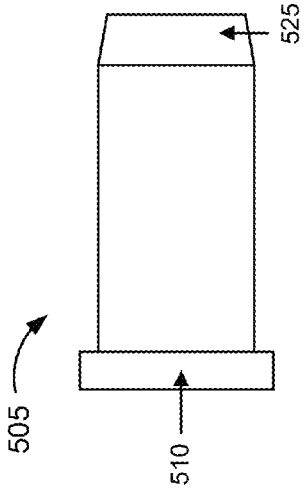
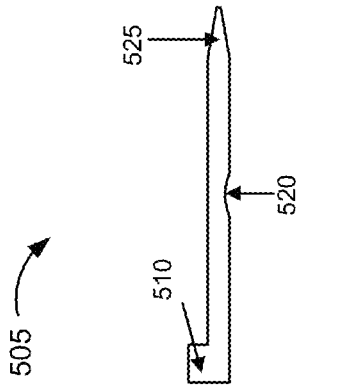


Fig. 5D



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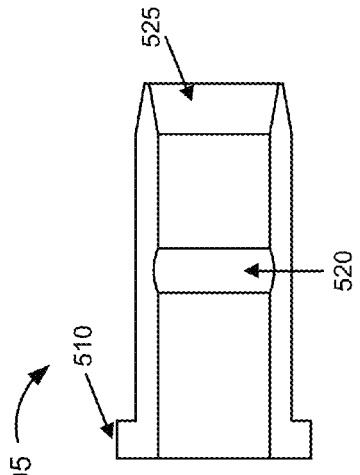

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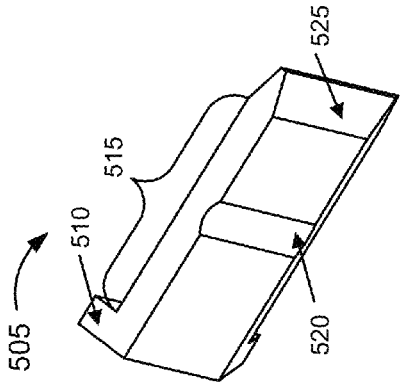

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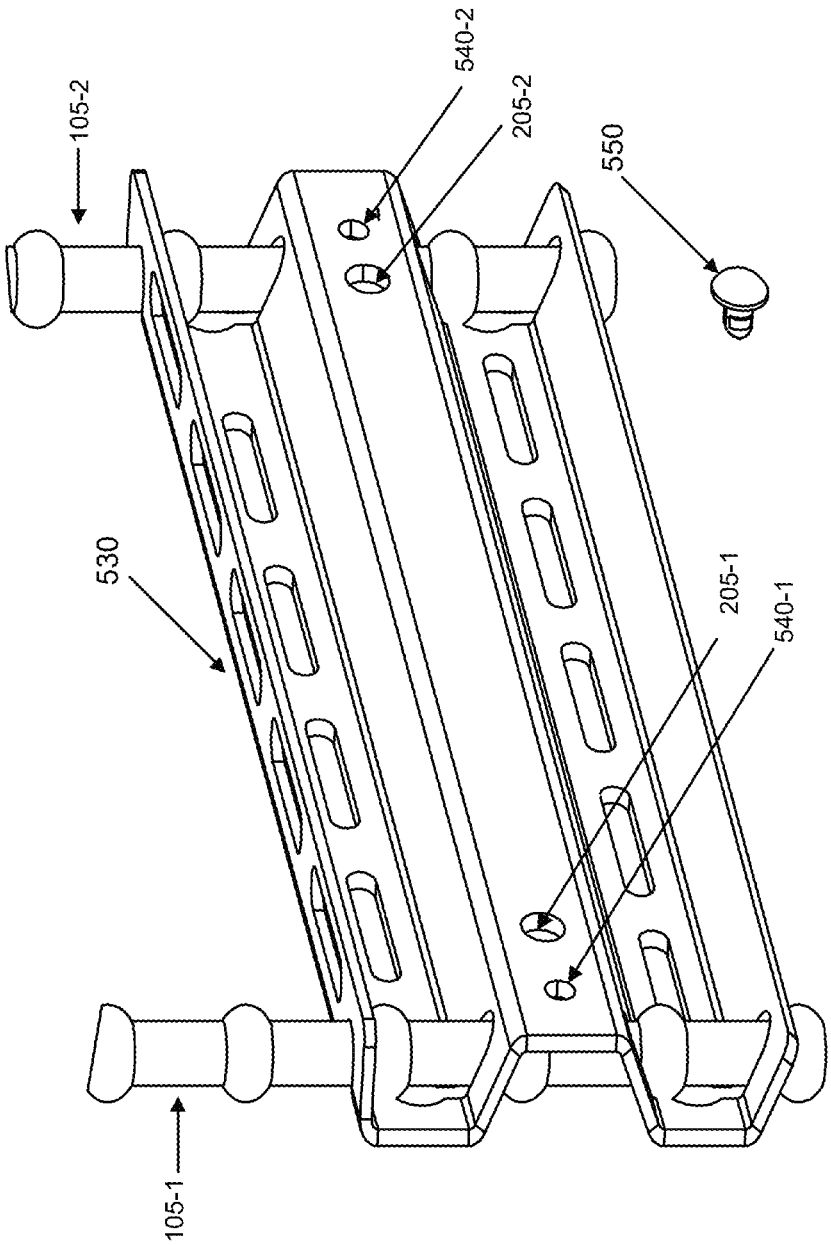

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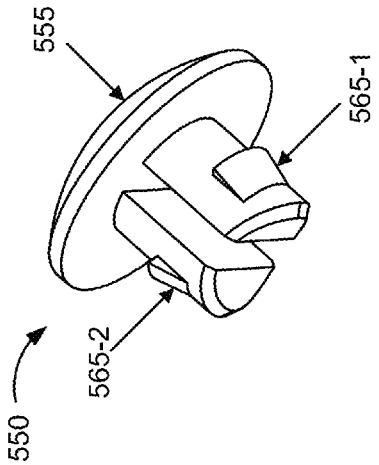


Fig. 5G

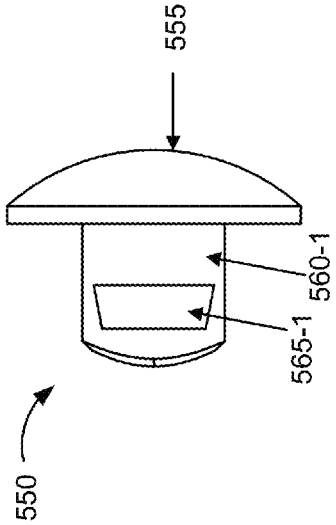
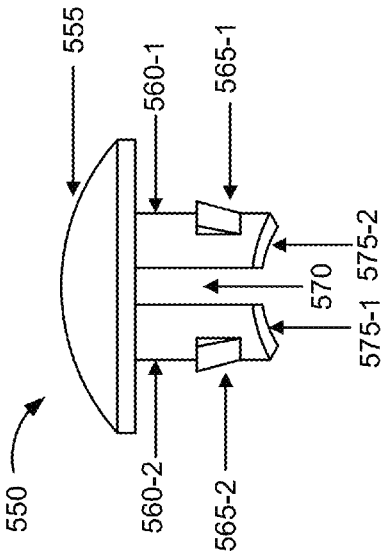


Fig. 5I



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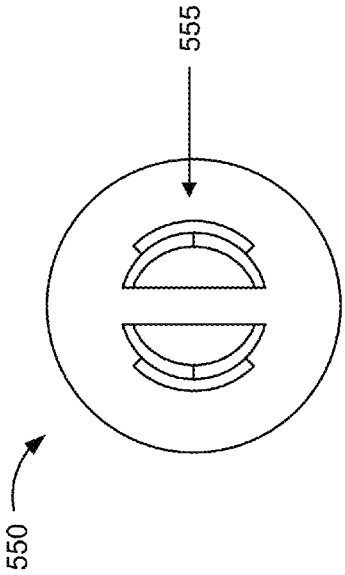


Fig. 5H

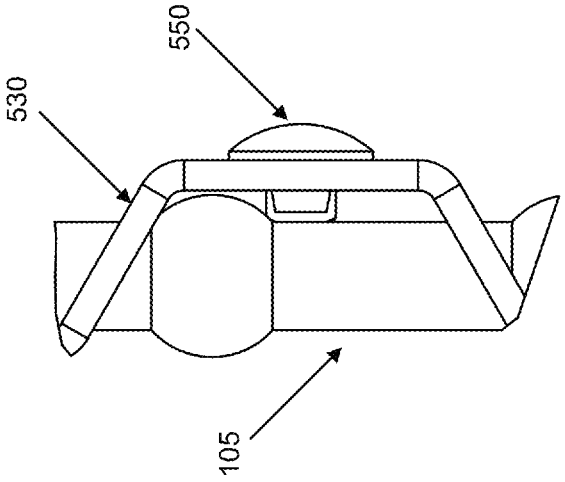


Fig. 5K

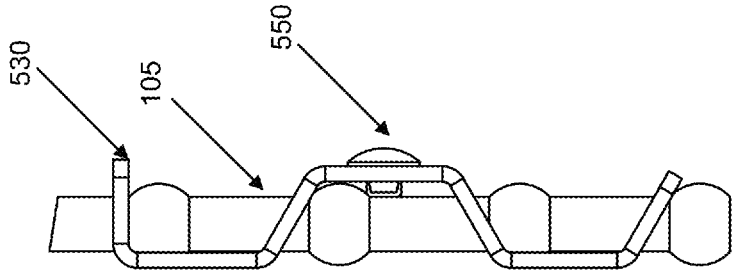


Fig. 5J

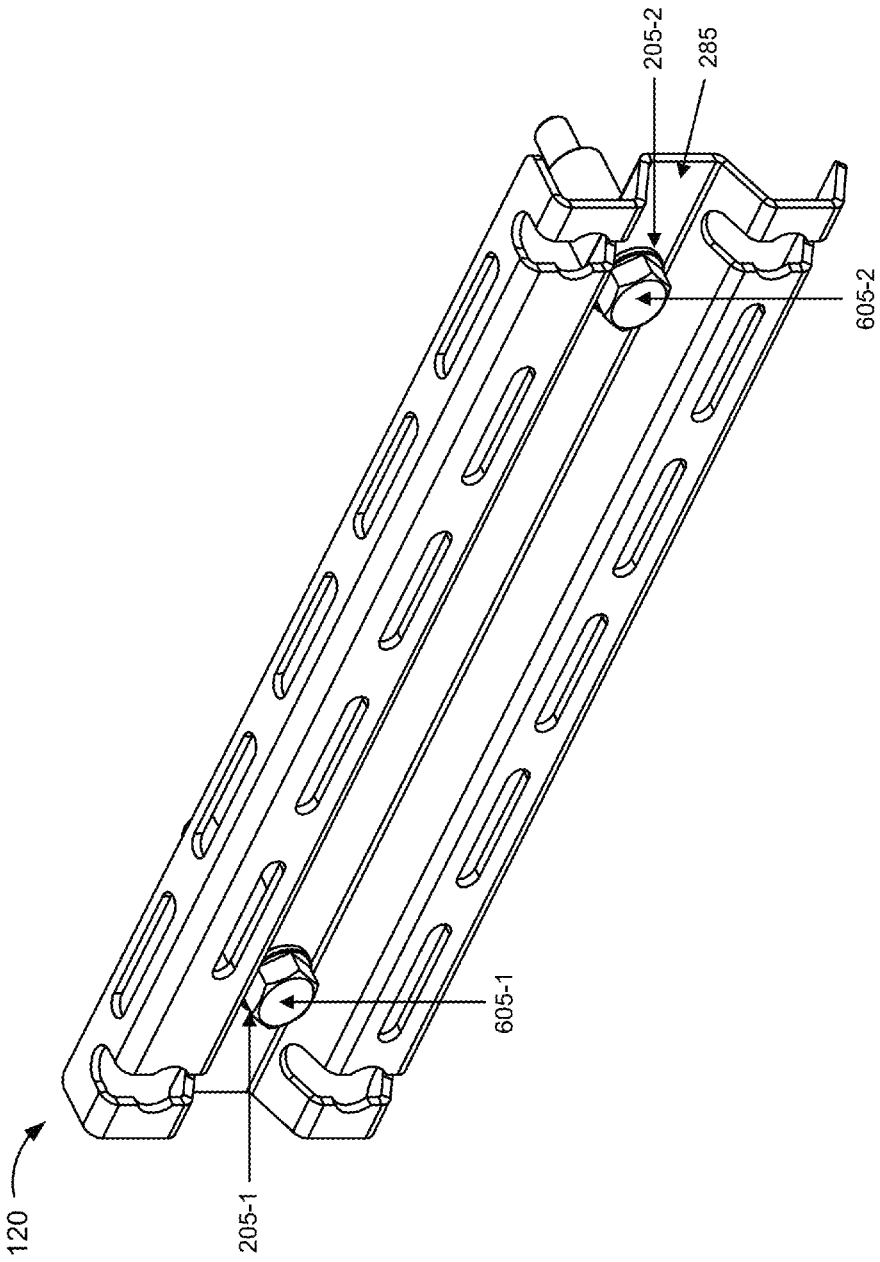


Fig. 6A

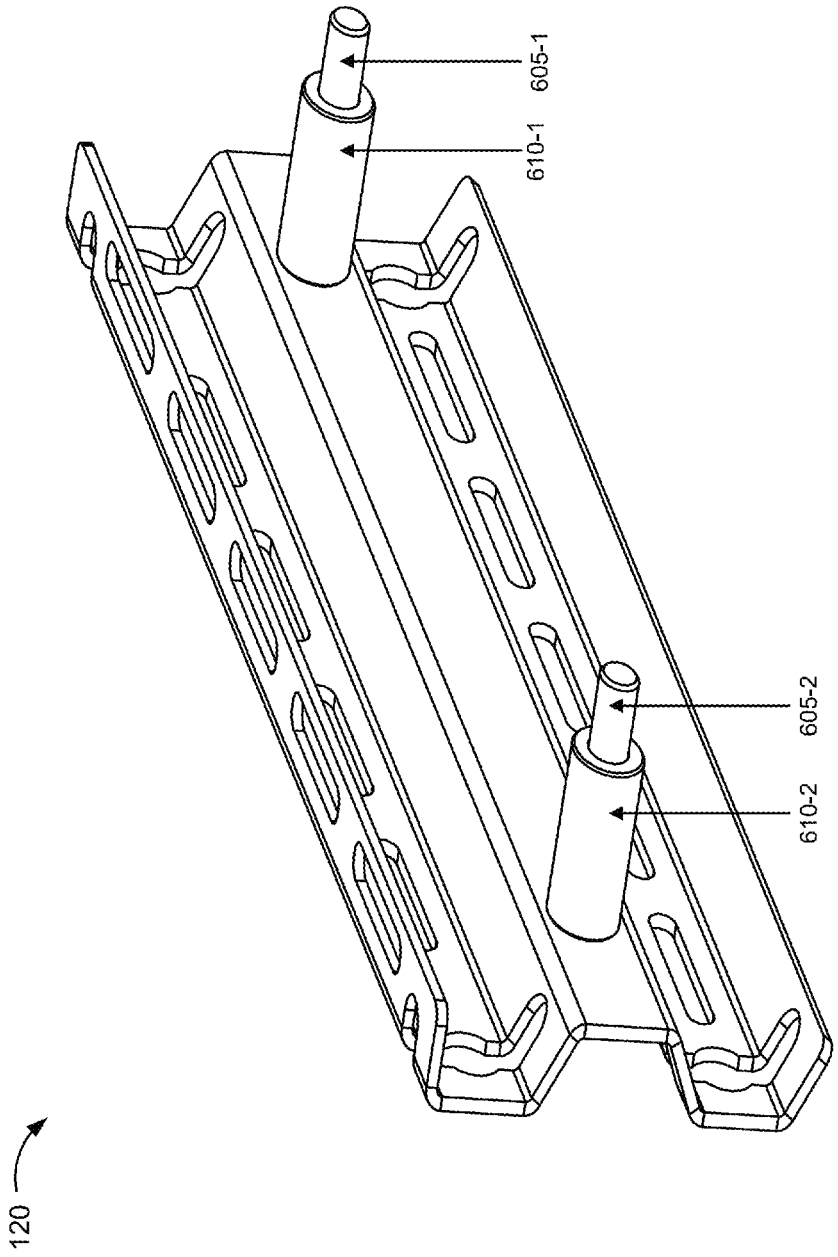
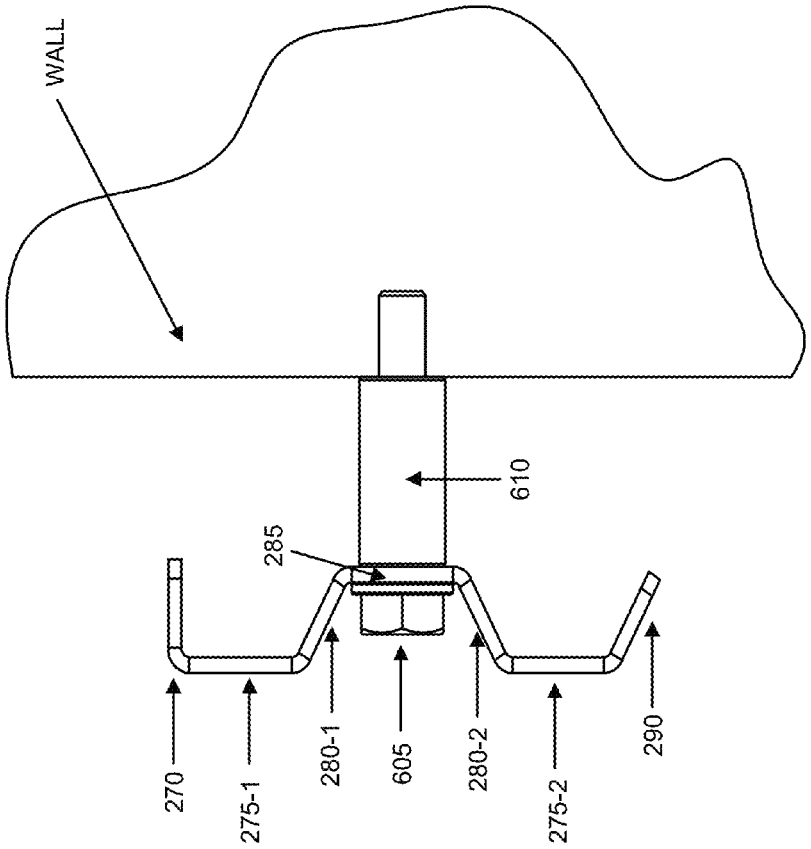


Fig. 6B



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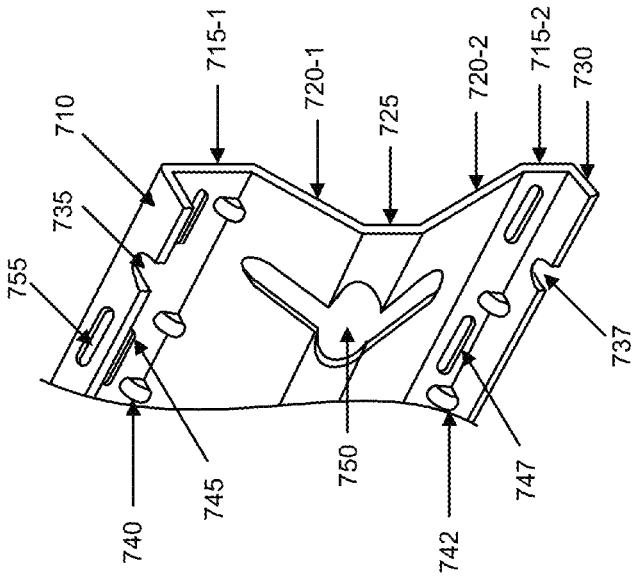
715-1
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Fig. 7A

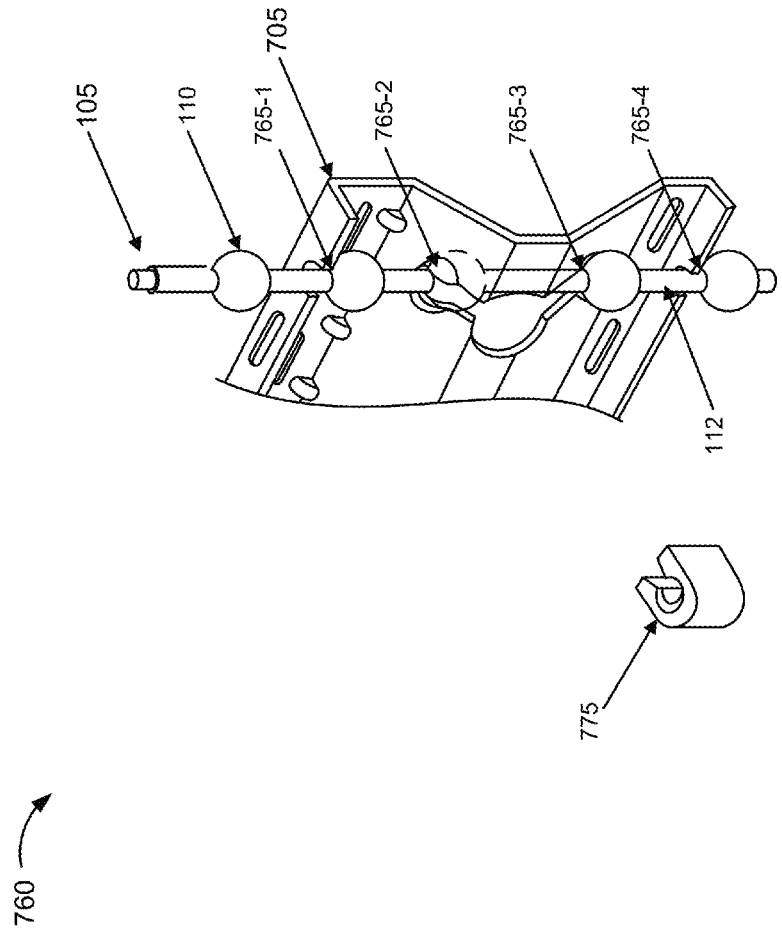
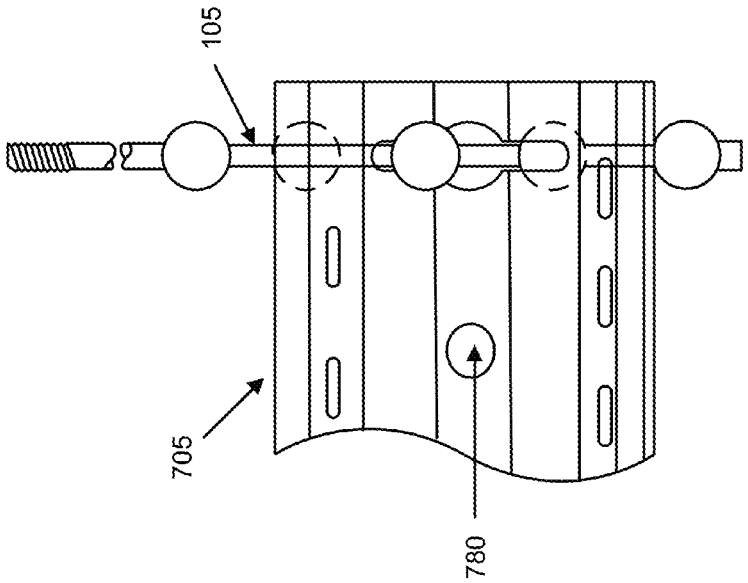


Fig. 7B



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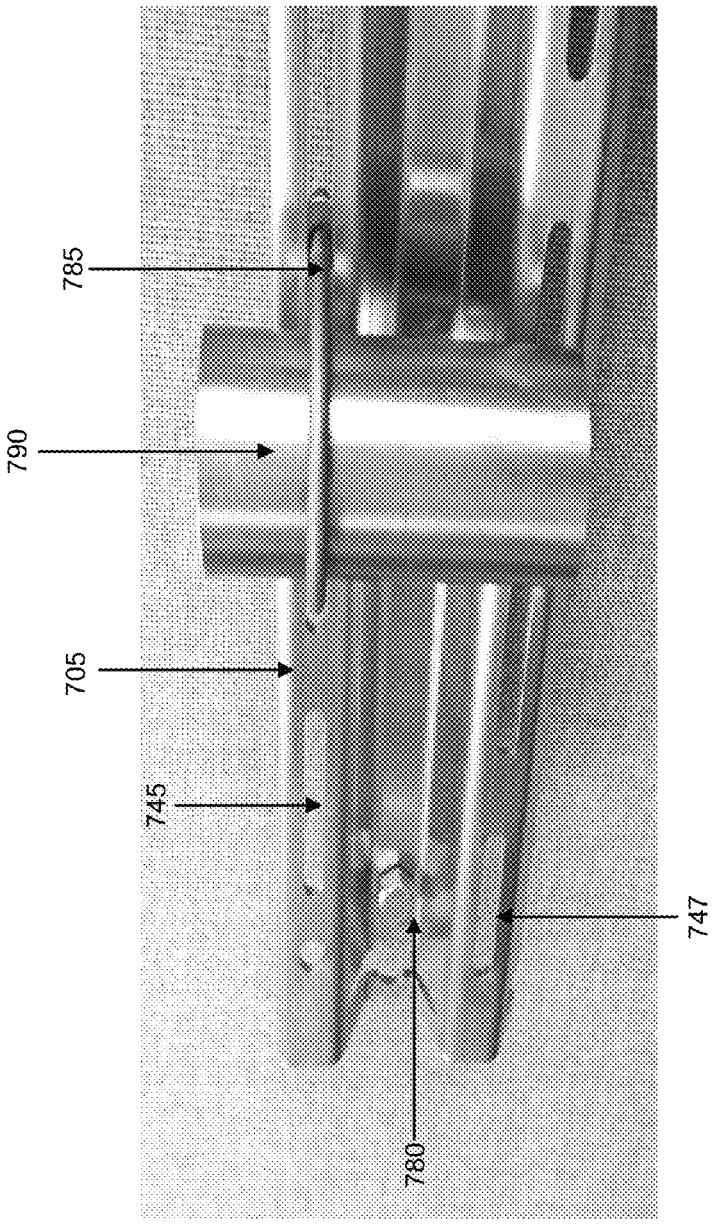

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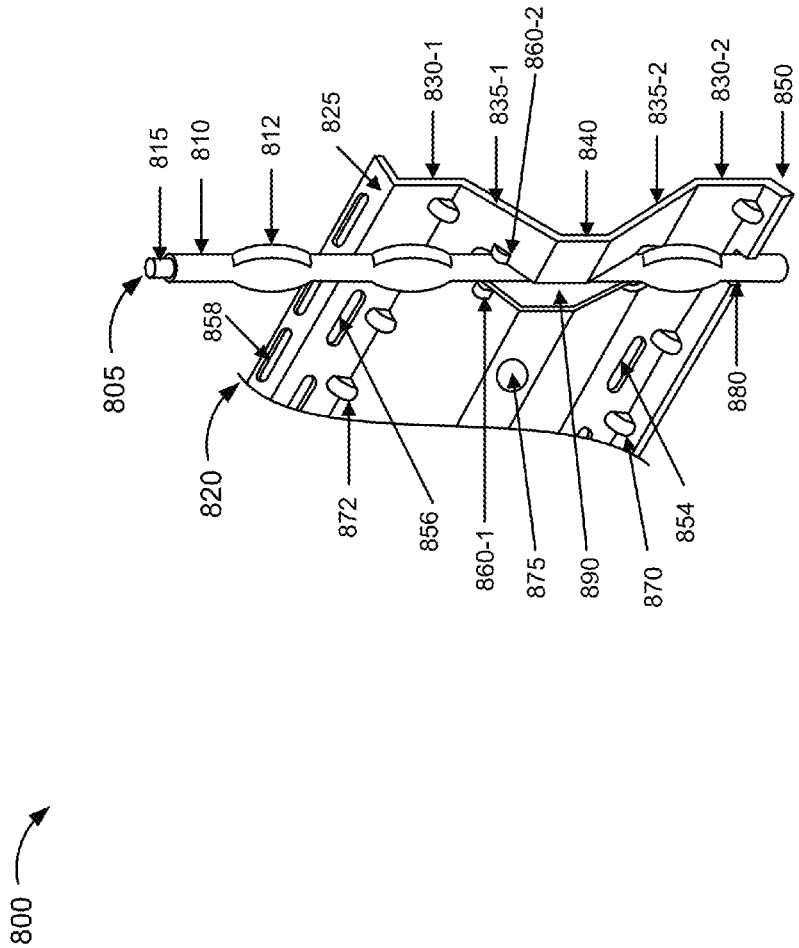
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Fig. 8A

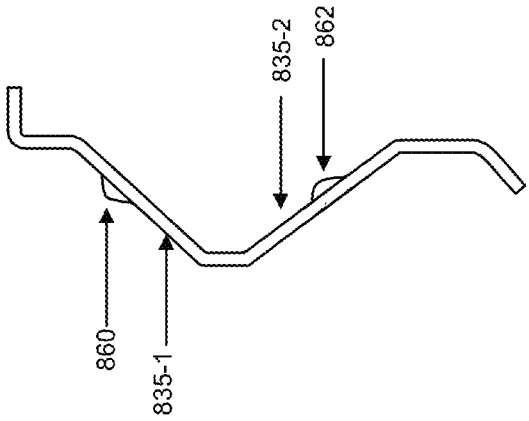

Fig. 8B

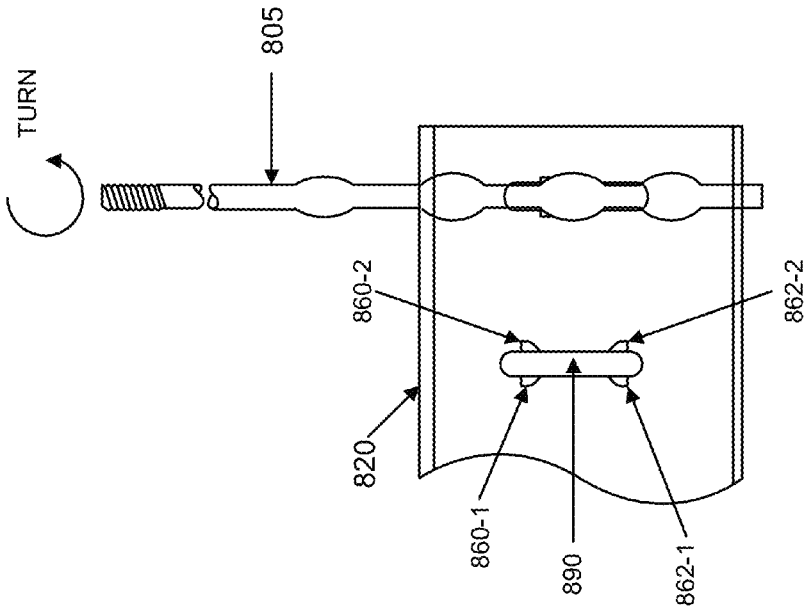

Fig. 8C

STRUT AND TRAPEZE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority under 35 U.S.C. §119, based on U. S. Provisional Patent Application No. 61/615,407, filed Mar. 26, 2012, the disclosure of which is hereby incorporated by reference herein.

BACKGROUND

Mounting systems can be used in a variety of industries, such as food processing and pharmaceutical venues. Wall-mounting systems and trapeze mounting systems are typically used to mount pipes, conduits, and tubes. These mounting systems are inherently difficult to clean, inspect, and by design are susceptible to accumulating various contaminants including dirt, insects, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B are diagrams illustrating isometric views of an exemplary embodiment of a mounting assembly;

FIG. **2**A is a diagram illustrating a flattened view of an exemplary embodiment of a strut;

FIG. **2**B is a diagram illustrating an end view of the strut;

FIG. **2**C is a diagram illustrating a top view of the strut;

FIG. **3**A is a diagram illustrating a side view of the mounting assembly;

FIGS. **3**B and **3**C are diagrams illustrating isometric views of the strut;

FIG. **3**D is a diagram illustrating a beaded-rod hole;

FIG. **3**E is a diagram illustrating a use case of the mounting assembly;

FIG. **4**A is a diagram illustrating a view of the mounting assembly;

FIGS. **4**B-**4**F are diagrams illustrating views of an exemplary embodiment of a locking tab;

FIGS. **5**A-**5**D are diagrams illustrating views of another exemplary embodiment of a locking tab;

FIG. **5**E is a diagram illustrating an isometric view of another exemplary embodiment a mounting assembly;

FIG. **5**F-**5**I are diagrams illustrating views of yet another exemplary embodiment of a locking tab;

FIGS. **5**J and **5**K are diagrams illustrating side views of the mounting assembly depicted in FIG. **5**E;

FIGS. **6**A-**6**C are diagrams illustrating views of a use case of the strut;

FIGS. **7**A-**7**D are diagrams illustrating views of another exemplary embodiment of a mounting assembly; and

FIGS. **8**A-**8**C are diagrams illustrating views of yet another exemplary embodiment of a mounting assembly.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements.

FIG. **1**A is a diagram illustrating an isometric view of an exemplary embodiment of an assembly **100**. As illustrated, assembly **100** includes beaded rods **105-1** and **105-2** (also referred to collectively as beaded rods **105** and individually as beaded rod **105**), a strut **120**, and locking tabs **140-1** and **140-2** (also referred to collectively as locking tabs **140** and individually as locking tab **140**).

As illustrated, each of beaded rods **105** includes beads **110-1** through **110**-X, in which X>1 (also referred to collectively as beads **110** or individually as bead **110**) and a rod **112**. Beaded rod **105-1** includes a threaded portion **115-1** and beaded rod **105-2** includes a threaded portion **115-2** (also referred to as threaded portions **115** and threaded portion **115**). According to an exemplary embodiment, bead **110**-X includes threading to allow the assembly of a series of beaded-rods **105**. For example, threaded portion **115-2** may be threaded into a threading of bead **110**-X. Beaded-rod **105** may be made from various materials, such as, for example, metal (e.g., stainless steel, aluminum, etc.) or a non-metallic material (e.g., plastic, a composite, etc.), depending on the load and/or application (e.g., food-grade, pharmaceutical, etc.) of assembly **100**.

Strut **120** includes holes to receive beaded-rods **105** and holes to allow strut **120** to be secured to a surface (e.g., a wall, etc.), as described further below. Additionally, strut **120** includes holes to receive an attachment (e.g., a U-bolt, a bracket, a clamp, etc.) to secure a fixture (e.g., a pipe, a tube, a conduit, a channel, etc.) to strut **120**. For example, according to an exemplary embodiment, strut **120** includes mounting holes **160-1** through **160**-Y, in which Y>1 (also referred to collectively as mounting holes **160** and individually as mounting hole **160**), and mounting holes **170-1** through **170**-Z, in which Z>1 (also referred to collectively as mounting holes **170** and individually as mounting hole **170**). Strut **120** also includes mounting holes **150-1** through **150**-X, in which X>1 (also referred to collectively as mounting holes **150** and individually as mounting hole **150**). Strut **120** may be made from a material similar to a material of beaded-rod **105**. Locking tab **140** includes a flexible member to assist in securing beaded rods **105** with strut **120**.

FIG. **1**B is a diagram illustrating another isometric view showing a reverse side of assembly **100**. Assembly **100** is a trapeze-type assembly in which beaded rods **105** suspend strut **120**. A wall-mount type assembly is also disclosed in this description. The elements of assembly **100** are described further below.

FIG. **2**A is a flattened view of strut **120**. As illustrated, strut **120** includes mounting holes **160** and mounting holes **170**. Strut **120** also includes holes **205-1** and **205-2** (also referred to collectively as holes **205** and individually as hole **205**).

Mounting hole **160** and mounting hole **170** each includes a hole to receive an attachment or a portion of an attachment to secure a fixture to strut **120**. According to an exemplary embodiment, mounting hole **160** and mounting hole **170** each has an elongated shape. Mounting holes **160** and mounting holes **170** may be equally spaced. Additionally, according to an exemplary embodiment, as illustrated in reference to imaginary line **210**, mounting holes **160** are offset from mounting holes **170**. In this way, mounting holes **160** and mounting holes **170** provide a continuous mounting hole access along the length of strut **120**. According to some use cases, the continuous mounting hole access may permit a user to mount attachments (e.g., U-bolts, brackets, clamps, etc.) and fixtures (e.g., pipes, tubes, conduits, etc.) with greater flexibility (e.g., closer together, etc.).

Hole **205** includes a hole to receive a fastener (e.g., a bolt, a screw, a nail, etc.). As described further below, according to a wall-mount embodiment, strut **120** may be secured using fasteners and holes **205**.

FIG. **2**B is a diagram illustrating an end view of strut **120**. As illustrated, strut **120** includes a top wall **270**, back walls **275-1** and **275-2** (also referred to collectively as back walls **275** and individually as back wall **275**), sloped walls **280-1**

and **280-2** (also referred to collectively as sloped walls **280** and individually as sloped wall **280**), an intermediate wall **285**, and a bottom wall **290**.

As illustrated, according to an exemplary embodiment, back walls **275-1** and **275-2** extend substantially perpendicular to top wall **270**. Additionally, intermediate wall **285** extends substantially perpendicular to top wall **270** and parallel to back walls **275**. Sloped wall **280-1** extends between back wall **275-1** and intermediate wall **285**, and sloped wall **280-2** extends between intermediate wall **285** and back wall **275-2**. According to an exemplary embodiment, sloped walls **280** are sloped approximately thirty-degrees relative to back walls **275**. According to another exemplary embodiment, the slopes of sloped walls **280** may be different (e.g., less than or greater than thirty degrees). For example, the slopes may be between twenty degrees and sixty degrees. As further illustrated, according to an exemplary embodiment, bottom wall **290** is sloped approximately thirty-degrees relative to back walls **275**. According to another exemplary embodiment, the slope of bottom wall **290** may be different (e.g., less than or greater than thirty degrees). For example, the slopes may be between twenty degrees and sixty degrees. In contrast to well-known strut designs, bottom wall **290** does not include a lip portion. In this way, the shape of strut **120** facilitates the run-off of water, etc, during cleaning and minimizes the collection of contaminants.

FIG. **2**C is a diagram illustrating a top view of strut **120**. As illustrated, top wall **270** includes mounting holes **150**. According to an exemplary embodiment, mounting hole **150** has a shape substantially similar to mounting hole **160** and mounting hole **170**.

FIG. **3**A is a diagram illustrating a side view of strut **120** and beaded-rod **105**. Beaded-rod **105** suspends strut **120** based on areas of contact **305-1** through **305-4** (also referred to collectively as area of contacts **305** and individually as area of contact **305**). As illustrated, each area of contact **305** includes portions of strut **120** in contact with bead **110** of beaded-rod **105**. The weight of strut **120** assists in stabilizing strut **120** on beaded rod **105**. As previously described, the coupling of beaded rod **105** with strut **120** is accomplished without a threaded connection.

FIGS. **3**B and **3**C are diagrams illustrating isometric view of strut **120**. As illustrated, strut **120** includes beaded-rod holes **320-1** and **320-2** (also referred to collectively as beaded-rod holes **320** and individually as beaded-rod hole **320**) and beaded-rod holes **322-1** and **322-2** (also referred to collectively as beaded-rod holes **322** and individually as beaded-rod hole **322**). Beaded-rod hole **320** and beaded-rod hole **322** each includes a hole that is shaped to receive beaded-rod **105** and couple beaded-rod **105** with strut **120**. FIG. **3**D is a diagram illustrating a flattened view of beaded-rod hole **320/322**. As illustrated, beaded-rod hole **320/322** includes a bead hole portion **324** that is shaped to receive bead **110** of beaded-rod **105** and rod hole portions **326-1** and **326-2** that are shaped to receive rod **112** of beaded-rod **105**. Referring back to FIG. **3**B, beaded-rod hole **320** extends from top wall **270** to back wall **275-1** to sloped wall **280-1**, and beaded-rod hole **322** extends from sloped wall **280-2** to back wall **275-2** to bottom wall **290**.

FIG. **3**E is a diagram illustrating strut **340** and beaded-rods **105**. As illustrated, an attachment **330** (e.g., a U-bolt) is attached to strut **120** using mounting holes **150** to secure a fixture **335** (e.g., a pipe). Strut **340** is similar to strut **705**, as described further below, in terms of, for example, including rod recesses and the walls defining a beaded-rod hole.

FIG. **4**A is a diagram illustrating a planar view of strut **120** and locking tabs **140**. As previously described, locking tabs **140** assist in securing beaded rods **105** with strut **120**. FIG. **4**B is a diagram illustrating an end view of locking tab **140**. As illustrated, locking tab **140** includes a lip portion **405**, a portion **410**, portions **415-1** and **415-2** (also referred to collectively as portions **415** and individually as portion **415**), portions **420-1** and **420-2** (also referred to collectively as portions **420** and individually as portion **420**), an intermediate portion **425**, and an end portion **430**.

Referring to FIG. **4**B, portion **410** extends substantially perpendicular from lip portion **405**. Also, portion **415-1** and portion **420-1** extend from intermediate portion **425** and portion **415-2** and portion **420-2** extend from intermediate portion **425** in a symmetric manner. Additionally, portion **410** and end portion **430** extend within a same, imaginary plane. According to an exemplary embodiment, intermediate portion **425** is shaped to receive a portion of rod **112** of beaded-rod **105**. For example, intermediate portion **425** may extend in a slightly curved manner. FIG. **4**C is a diagram illustrating a planar view of locking tab **140**. FIGS. **4**D through **4**F are diagrams illustrating isometric views of locking tab **140**. As illustrated, locking tab **140** extends in an undulating manner from portion **410** to end portion **430**.

Referring back to FIG. **1**A and FIG. **1**B, lip portion **405** is placed at an end side of strut **120** and the remaining portions of locking tab **140** extend along another side of strut **120**. Locking tab **140** assists in maintaining the position of strut **120** in relation to beaded-rod **105**. For example, an edge of locking tab may have contact with an underside of bead **110** and an opposite edge of locking tab **140** may have contact with sloped wall **280-2**. Additionally, intermediate portion **425** may have contact with rod portion **112** of beaded-rod **105**. Locking tab **140** may provide a spring-like urging based on the material of locking tab **140** and contacts areas of strut **120** and beaded-rod **105**.

FIGS. **5**A-**5**D are diagrams illustrating another exemplary embodiment of a locking tab. Referring to FIG. **5**A, a locking tab **505** includes a lip portion **510** a main body portion **515** that includes a rod portion **520**, and an end portion **525**. As illustrated main body portion **515** extends substantially perpendicular from lip portion **510**. Rod portion **520** is contoured to receive rod **112** of beaded-rod **105**. End portion **525** is wedge-shaped. The shape of end portion **525** may assist a user in inserting locking tab **505** between strut **120** and beaded-rod **105**. Locking tab **505** may be used in a manner similar to that illustrated in FIGS. **1**A and **1**B, in which lip portion **510** is placed at an end side of strut **120** and main body **515** and end portion **525** extend along another side of strut **120**.

FIG. **5**E is a diagram illustrating an isometric view of another exemplary embodiment of a mounting assembly. As illustrated, a strut **530** includes a structure similar to strut **120**. However, strut **530** includes tab holes **540-1** and **540-2** (also referred to collectively as tab holes **540** and individually as tab hole **540**) that are proximate to holes **205**, which receive a fastener (e.g., for wall-mounting). Tab holes **540** are shaped to receive a locking tab **550**.

FIG. **5**F-**5**I are diagrams illustrating views of yet another exemplary embodiment of a locking tab **550**. Referring to FIG. **5**F, locking tab **550** includes a head portion **555**, stems **560-1** and **560-2** (also referred to collectively as stems **560** and individually as stem **560**), tabs **565-1** and **565-2** (also referred to collectively as tabs **565** and individually as tab **565**), a gap **570**, and rod portions **575-1** and **575-2** (also referred to collectively as rod portions **575** and rod portion **575**). Locking tab **550** may be made from materials similar to those described for strut **120**.

Head portion **555** includes a dome-shaped portion. Stems **560** extend from head portion **555** in a substantially perpen-

dicular manner. Stem **560** has a semi-circular column or rod shape. Tabs **565** may be flexible and provide a frictional engagement when inserted into tab holes **540**. Tabs **565** flare outwardly in relation to stems **560**. Gap **570** provides a space between stems **560**. Rod portions **575** are curved shaped so as to make contact with rod portion **112** of beaded-rod **105**.

FIGS. **5**J and **5**K are diagrams illustrating side views of the mounting assembly depicted in FIG. **5**E. When locking tab **550** has been inserted into tab hole **540**, head portion **555** has a diameter that hides tab hole **540** when head portion **555** rests against an intermediate wall of strut **530**. During insertion, stem **560** may move inward within gap **570** as locking tab **550** is inserted into tab hole **540**, and tabs **565** contact the perimeter wall defining tab hole **540**. Stems **560** may move back to their original position once locking tab **550** is completely inserted. Tabs **565** may provide a locking effect and rod portions **575** may come in contact with rod portion **112** of beaded-rod **105** or be situated substantially close to rod portion **112** of beaded-rod **105**.

FIGS. **6**A-**6**B are diagrams illustrating an isometric view of strut **120**. In contrast to FIGS. **1**A and **1**B, in which strut **120** is illustrated according to a trapeze-mount use case, FIGS. **6**A and **6**B illustrate strut **120** according to a wall-mount use case. Referring to FIG. **6**A, fasteners **605-1** and **605-2** are inserted in holes **205**. Referring to FIG. **6**B, stand-offs **610-1** and **610-2** may be used to provide space between strut **120** and a wall-mountable surface. FIG. **6**C is a diagram illustrating an end view of a wall-mount use case of strut **120**.

FIG. **7**A is a diagram illustrating an isometric view of another exemplary embodiment of a strut. As illustrated, a portion of a strut **705** includes a top wall **710**, back walls **715-1** and **715-2** (also referred to collectively as back walls **715** and individually as back wall **715**), sloped walls **720-1** and **720-2** (also referred to collectively as sloped walls **720** and individually as sloped wall **720**), an intermediate wall **725**, and a bottom wall **730**. Strut **705** may be made from a material previously described for strut **120**.

As illustrated, according to an exemplary embodiment, back walls **715** extend substantially perpendicular to top wall **710**. Additionally, intermediate wall **725** extends substantially perpendicular to top wall **710** and parallel to back walls **275**. According to an exemplary embodiment, sloped walls **720** are sloped approximately thirty-degrees relative to back walls **275**. According to another embodiment, the slopes of sloped walls **720** may be different (e.g., less than or greater than thirty degrees). According to an exemplary embodiment, bottom wall **730** is sloped approximately thirty-degrees relative to back walls **275**. According to another embodiment, the slope of bottom wall **730** may different (e.g., (e.g., less than or greater than thirty degrees).

Strut **705** includes a rod recess **735** situated on top wall **710** and a rod recess **737** situated on bottom wall **730**. As illustrated, rod recess **735** and rod recess **737** is each shaped to receive rod **112** of beaded-rod **105**. Strut **705** includes ribs **740** proximate to mounting holes **745** and ribs **742** proximate to mounting holes **747**. Ribs **740** and ribs **742** provide added support to strut **705**. Similar to mounting holes **160** and **170**, mounting holes **745** and mounting holes **747** include holes to receive an attachment or a portion of an attachment that may be used to secure a fixture. Additionally, similar to mounting holes **160** and **170**, mounting holes **745** are offset from mounting holes **747**.

Strut **705** also includes a beaded-rod hole **750**. Since FIG. **7**A illustrates a portion of strut **705**, strut **705** includes two beaded-rod holes **750**, each proximate to an end of strut **705**. In contrast to strut **120**, strut **705** includes a single beaded-rod hole **750** proximate to the end of strut **705**. Additionally, as illustrated in FIG. **7**A, beaded-rod hole **750** is formed by sloped walls **720** and intermediate wall **725**.

FIG. **7**B is a diagram illustrating an isometric view of an exemplary embodiment of an assembly **760**. Beaded-rod **105** couples to strut **705** when beaded-rod **105** is inserted into beaded-rod hole **750**. As illustrated, beaded-rod **105** suspends strut **705** based on area of contacts **765-1** through **765-4** (also referred to collectively as area of contacts **765** and individually as area of contact **765**). Each area of contact **765** includes a portion of strut **705** in contact with bead **110**.

Assembly **760** also includes a locking tab **775**. Locking tab **775** is shaped to receive rod **112** of beaded-rod **105**. Locking tab **775** assists in securing beaded-rod **105** with strut **705**. For example, similar to locking tab **140**, locking tab **775** may prevent strut **705** from moving (e.g., upwards). Locking tab **775** may snap around rod **112** located between area of contacts **765-3** and **765-4**. FIG. **7**C is a diagram illustrating a flattened view of strut **705** and beaded-rod **105**. As illustrated, strut **705** includes a hole **780** similar to hole **205** of strut **120**. Hole **780** may be used to receive a fastener (e.g., a bolt, a screw, a nail, etc.) to secure strut **705** to a surface. FIG. **7**D is a diagram illustrating a perspective view of strut **705** according to a wall-mount case. An attachment **785** (e.g., a U-bolt) secures a fixture **790** (e.g., a pipe) to strut **705** using mounting holes **745**.

FIG. **8**A is a diagram illustrating an isometric view of a portion of an exemplary embodiment of an assembly **800**. As illustrated, assembly **800** includes a flattened beaded-rod **805** and a strut **820**. Flattened beaded-rod **805** includes a rod **810**, a flattened bead **812**, and a threaded portion **815**. Similar to beaded-rod **105**, flattened beaded-rod **805** may have threading at the other end of flattened beaded-rod **805** to allow a series of flattened beaded-rods **805** to be connected. Flattened beaded-rod **805** may be made from a material previously described for beaded-rod **105**.

Strut **820** includes a top wall **825**, back walls **830-1** and **830-2** (also referred to collectively as back walls **830** and individually as back wall **830**), sloped walls **835-1** and **835-2** (also referred to collectively as sloped walls **835** and individually as sloped wall **835**), an intermediate wall **840**, and a bottom wall **850**. Strut **820** may be made from a material previously described for strut **120**. The walls of strut **820** are also similar to strut **120**, such as back walls **830** are substantially perpendicular to top wall **825**, etc.

In contrast to strut **120** and strut **705**, top wall **825** of strut **820** extends in a somewhat opposite direction than bottom wall **850**. Additionally, in contrast to strut **120** and strut **705**, strut **820** includes embossments **860-1** and **860-2** (also referred to collectively as embossments **860** and individually as embossment **860**). Although not illustrated in FIG. **8**A, embossments are similarly situated on an opposite side of sloped wall **835-2**. For example, referring to FIG. **8**B, strut **820** includes embossments **860** on sloped wall **835-1** and embossments **862** on an opposite side of sloped wall **835-2**.

Referring back to FIG. **8**A, similar to strut **120**, strut **820** includes an array of mounting holes **854** along sloped wall **830-2**, an array of mounting holes **856** along back wall **830-1**, and an array of mounting holes **858** along top wall **825**. Strut **820** includes ribs **870** and ribs **872**, a hole **875** for attaching strut **820** to a surface, a rod recess **880**, and a flattened beaded-rod hole **890**.

Referring to FIG. **8**C, a flattened view of strut **820** includes flattened beaded-rod hole **890** and embossments **860** and **862**. In contrast to beaded-rod hole **320**/**322** that includes a bead hole portion **324** having a shape of bead **110** (as illustrated in FIG. **3**D), flattened beaded-rod hole **890** has a uniform shape based on the shape of flattened beads **812** and the method of

inserting flattened beaded-rod **805** is inserted in flattened beaded-rod hole **890**. For example, to insert flattened beaded-rod **805** into flattened beaded-rod hole **890**, flattened beaded-rod **805** is twisted so flattened bead **812** fits into the elongated shape of flattened beaded-rod hole **890**. Thereafter, flattened beaded-rod **805** is twisted again (e.g., to a position illustrated in FIG. **8**A) so portions of flattened bead **812** rest proximate to embossments **860** and **862**.

According to an exemplary embodiment, an assembly includes a strut that is shaped or contoured to minimize or prevent the collection of contaminants. According to an exemplary embodiment, a bottom wall of the strut does not include a lip. According to an exemplary embodiment, the strut includes mounting holes that are offset, as described herein.

According to an exemplary embodiment, the assembly includes beaded rods. The beaded rods are configured to suspend a strut without the use of threaded connections to couple the beaded rods to the strut. For example, the strut may be coupled to the beaded rods without nuts, washers, bolts, fasteners, and the like.

According to an exemplary implementation, beads of the beaded rod are equally spaced. According to an exemplary implementation, the beads are shaped in an oval, an elliptical, or a spherical manner. According to another exemplary implementation, the beads are shaped in an oval-flattened, an elliptical-flattened, or a spherical-flattened manner. According to an exemplary embodiment, the beaded rod includes a threaded portion. For example, the threaded portion may be used to suspend the beaded rod from a surface (a ceiling, etc.) or other system for hanging objects.

The foregoing description of embodiments provides illustration, but is not intended to be exhaustive or to limit the embodiments to the precise form disclosed. Accordingly, modifications to the embodiments described herein may be possible. By way of example, beads **110** may be implemented having shapes other than oval, oval-flattened, etc., such as cubic, rectangular, etc. According to another example, a strut may be modified to include fewer walls. For example, a strut may include a top wall, a back wall, a sloped wall, another back wall, and another sloped wall. According to such a modification, the strut may include a pair of beaded-rod holes. According to another example, for example, referring to FIGS. **6**A-**6**C, a strut may not include holes **205** within intermediate wall **285**. Rather, the strut may include holes **205** within both back walls **275**. According to yet another example, referring to FIGS. **6**A-**6**C, a strut may be mounted in which the strut is reversed (e.g., horizontally flipped) and attachments and fixtures may be mounted to, for example, the intermediate wall of the strut.

The terms "a," "an," and "the" are intended to be interpreted to include one or more items. Further, the phrase "based on" is intended to be interpreted as "based, at least in part, on," unless explicitly stated otherwise. The term "and/or" is intended to be interpreted to include any and all combinations of one or more of the associated items.

In the specification and illustrated by the drawings, reference is made to "an exemplary embodiment," "an embodiment," "embodiments," etc., which may include a particular feature, structure or characteristic in connection with an embodiment(s). However, the use of the phrase or term "an embodiment," "embodiments," etc., in various places in the specification does not necessarily refer to all embodiments described, nor does it necessarily refer to the same embodiment, nor are separate or alternative embodiments necessarily mutually exclusive of other embodiment(s).

Although the invention has been described in detail above, it is expressly understood that it will be apparent to persons skilled in the relevant art that the invention may be modified without departing from the spirit of the invention. Various changes of form, design, or arrangement may be made to the invention without departing from the spirit and scope of the invention. Therefore, the above-mentioned description is to be considered exemplary, rather than limiting, and the true scope of the invention is that defined in the following claims.

What is claimed is:

1. An assembly comprising:

a strut comprising a first member having a multi-sided profile, one or more of the sides including:

mounting holes to affix one or more attachments and one or more fixtures to the first member, and

a set of two or more support holes transversely aligned with respect to the first member to receive and couple a rod, for suspension of the strut from a support structure, wherein each of the support holes is formed in three or more of the sides adjacent to each other; and

the rod, including:

at least two bead-like portions spaced apart to fit in the support holes to form a non-threaded coupling, and

a threaded end portion that connects to another rod via a threaded opening of a bead-like portion located at an end of the other rod.

2. The assembly of claim **1**, wherein the multi-sided profile of the strut comprises:

a first sloped surface;

a first vertical surface that extends from the first sloped surface; and

a bottom surface that extends from the first vertical surface, and wherein the bottom surface is sloped in relation to the first vertical surface, wherein a first one of the set of support holes is defined within the first sloped surface, the first vertical surface, and the bottom surface.

3. The assembly of claim **2**, wherein the multi-sided profile of the strut further comprises:

a top surface;

a second vertical surface that extends from the top surface; and

a second sloped surface that extends from the second vertical surface to an intermediary surface that extends to the first sloped surface, and wherein a second one of the set of support holes is defined within the top surface, the second vertical surface, and the second sloped surface.

4. The assembly of claim **1**, wherein the at least two bead-like portions are equally spaced apart on the rod.

5. The assembly of claim **1**, wherein the multi-sided profile of the strut comprises:

a first vertical surface that includes a first set of the mounting holes, wherein the first set of the mounting holes are equally spaced apart along a portion of the first member; and

a second vertical surface that includes a second set of the mounting holes, wherein the second set of the mounting holes are equally spaced apart along the portion of the first member, and wherein the first set of the mounting holes are offset relative to the second set of the mounting holes along the portion of the first member.

6. The assembly of claim **1**, further comprising:

one or more locking tabs that secure the rod to the first member of the strut.

7. The assembly of claim **1**, wherein the multi-sided profile of the strut comprises:

a top surface that includes one or more recesses to receive a first portion of the rod; and

a bottom surface that includes one or more recesses to receive a second portion of the rod.

8. The assembly of claim **1**, wherein the non-threaded coupling comprises at least four areas of contact between portions of the rod and portions of the first member.

9. An assembly comprising:

a set of rods, each rod including a series of bead-like portions spaced apart along a length of the rod between opposite ends of the rod including a threaded end and a bead-like end having a threaded opening for coupling of the rods; and

a strut comprising a first member having a multi-sided profile, one or more of the sides including:

mounting holes to affix one or more attachments and one or more fixtures to the first member, and

a set of two or more support holes transversely aligned within the first member to receive and couple one of the rods perpendicularly with the strut for suspension of the strut from a support, wherein each of the support holes is defined in three or more of the sides adjacent to each other, and spaced apart to correspond to a spacing of the series of bead-like portions of the rod for forming a non-threaded coupling.

10. The assembly of claim **9**, wherein the multi-sided profile of the strut comprises:

a first sloped section having a first slope;

a second sloped section having a second slope that is oppositely sloped relative to the first slope; and

an intermediate section that extends from the first sloped section to the second sloped section, and wherein a first one of the support holes extends from the first sloped section to the intermediate section and to the second sloped section.

11. The assembly of claim **9**, wherein the non-threaded coupling comprises at least four areas of contact between portions of the rod and portions of the first member.

12. The assembly of claim **9**, wherein the multi-sided profile of the strut comprises:

a top section,

a first vertical section extending substantially perpendicularly from the top section;

a first sloped section extending from the first vertical section;

an intermediate section extending from the first sloped section and substantially perpendicular to the top section;

a second sloped section extending from the intermediate and substantially oppositely sloped relative to the first sloped section;

a second vertical section extending from the second sloped section and substantially coplanar with the first vertical section; and

a bottom section that extends from the second vertical section, wherein the bottom section is sloped in relation to the second vertical section.

13. The assembly of claim **12**, wherein each of the support holes is proximate to an end of the first member, and wherein a first one of the set of support holes extends from the top to the first vertical section and to the first sloped section, and wherein a second one of the set of support holes extends from the second sloped section to the second vertical section to the bottom section.

14. The assembly of claim **12**, wherein a first set of mounting holes is defined within the top section, a second set of mounting holes is defined within the first vertical section, and a third set of mounting holes is defined within the second vertical section.

15. An assembly comprising:

a strut comprising a first member having a multi-sided profile, including:

a top section,

a first vertical section extending substantially perpendicularly from the top section;

a first sloped section extending from the first vertical section;

an intermediate section extending from the first sloped section and substantially perpendicular to the top section;

a second sloped section extending from the intermediate and substantially oppositely sloped relative to the first sloped section;

a second vertical section extending from the second sloped section and substantially perpendicular to the top section and coplanar with the first vertical section, wherein the intermediate section is parallel to but not coplanar with each of the first vertical section and the second vertical section;

a bottom section that extends from the second vertical section, wherein the bottom section is sloped in relation to the second vertical section;

a set of support holes transversely aligned with respect to the first member to receive and couple to a rod for suspension of the strut from a support structure, wherein a first support hole is formed through each of the top section, the first vertical section, and the first sloped section, and wherein a second support hole is formed through each of the second sloped section, the second vertical section, and the bottom section; and

the rod, wherein the rod includes bead-like portions spaced apart to fit in the first and second support holes to form a non-threaded coupling.

16. The assembly of claim **15**, wherein the first sloped section, the second sloped section, and the bottom section have substantially a same amount of sloping.

17. The assembly of claim **16**, wherein the same amount of sloping is between thirty degrees and sixty degrees.

18. The assembly claim **15**, wherein the first vertical section includes a first set of mounting holes, wherein the first set of the mounting holes are equally spaced apart along a portion of the first member; and

the second vertical section includes a second set of mounting holes, wherein the second set of the mounting holes are equally spaced apart along the portion of the first member, and offset to the first set of mounting holes of the first vertical section.

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